

Hawaii Renewable Energy Resource Assessment



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Background

- ***Renewable Energy Resource Assessment and Development Program*** completed by GEC in 1995 as part of the Hawaii Energy Strategy
 - Identified potential sites for renewable energy projects in Hawaii
 - Collected wind and solar resource data
 - Developed cost and performance estimates for each potential project

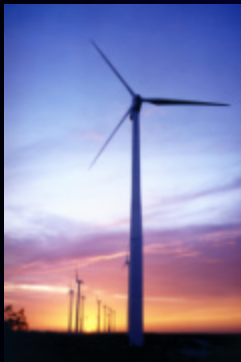
Hawaii's Abundant Renewable Energy Resources

- *Wind*
- *Solar*
- *Geothermal*
- *Biomass*
- *Hydro*
- *Ocean technologies*



Approach to Estimating Cost and Performance

- *Cost and performance based on site-specific resource data and conditions*
- *Two conceptual plant designs were developed*
 - *Current technology*
 - *Future technology*
- *Optimistic, nominal, and conservative cases were considered to account for uncertainty*
- *Costs were estimated consistent with EPRI TAG methodology*



Approach to Estimating Cost and Performance (cont.)

- *Costs include permitting, interconnection, land acquisition, equipment, installation, commissioning, and O&M*
- *Transmission upgrade requirements based on best available information or utility IRP estimates*
- *Cost of energy calculated for each project for comparison purposes*



Update of Selected Cost and Performance Estimates

- *Completed for DBEDT in late 2000*
- *Focused on most promising technologies and locations*
- *Projects offer near-term opportunities*
- *Representative sampling – other projects are possible*
- *Most projects described in 1995 report; some variations*

List of Projects Included in 2000 Update

Technology	Island	Location	Capacity MW
Geothermal	Hawaii	Kilauea [1]	8, 22
Hydroelectric	Hawaii	Umauma Stream	13.8
	Kauai	Wailua River	6.6
Photovoltaic	Hawaii	N Kohola	5
	Oahu	Pearl Harbor	5
Wind	Hawaii	Kahua Ranch [2]	10
		Lalamilo Wells	3, 30, 50
		North Kohala	5, 15
	Kauai	N. Hanapepe	10
		Port Allen	5
	Maui	McGregor Point [2]	20
		NW Haleakala	10, 30, 50
		Puunene	10, 30
	Oahu	Kaena Point	3, 15
		Kahuku	30, 50, 80

[1] The 8 MW project is a topping unit that could be added to the existing 30 MW facility. The 22 MW project could be installed in 2005 as a separate power plant at the same location.

[2] Future projects were not evaluated because actual projects are currently under development which will preclude additional projects at these locations.

Cost of Energy – Current Projects (2000)

Technology	Island	Location	Capacity MW	COE \$/kWh
Geothermal	Hawaii	Kilauea	8	\$0.045
Hydroelectric	Hawaii	Umauma Stream	13.8	\$0.076
	Kauai	Wailua River	6.6	\$0.093
Photovoltaics	Hawaii	N Kohola	5	\$0.298
	Oahu	Pearl Harbor	5	\$0.305
Wind	Hawaii	Kahua Ranch	10	\$0.055
		Lalamilo Wells	3	\$0.044
		Lalamilo Wells	30	\$0.046
		Lalamilo Wells	50	\$0.044
		North Kohala	5	\$0.043
		North Kohala	15	\$0.043
	Kauai	N. Hanapepe	10	\$0.067
		Port Allen	5	\$0.073
	Maui	McGregor Point	20	\$0.051
		NW Haleakala	10	\$0.055
		NW Haleakala	30	\$0.064
		NW Haleakala	50	\$0.061
		Puunene	10	\$0.077
		Puunene	30	\$0.083
	Oahu	Kaena Point	3	\$0.068
		Kaena Point	15	\$0.070
		Kahuku	30	\$0.067
		Kahuku	50	\$0.059
		Kahuku	80	\$0.069

Cost of Energy – Future Projects (2010)

Technology	Island	Location	Capacity MW	COE \$/kWh
Geothermal	Hawaii	Kilauea (in 2005)	22	\$0.044
Hydroelectric	Hawaii	Umauma Stream	13.8	\$0.075
	Kauai	Wailua River	6.6	\$0.092
Photovoltaics	Hawaii	N Kohala	5	\$0.205
	Oahu	Pearl Harbor	5	\$0.212
Wind	Hawaii	Lalamilo Wells	3	\$0.037
		Lalamilo Wells	30	\$0.038
		Lalamilo Wells	50	\$0.037
		North Kohala	5	\$0.036
		North Kohala	15	\$0.036
	Kauai	N. Hanapepe	10	\$0.057
		Port Allen	5	\$0.062
	Maui	NW Haleakala	10	\$0.047
		NW Haleakala	30	\$0.053
		NW Haleakala	50	\$0.051
		Puunene	10	\$0.061
		Puunene	30	\$0.069
	Oahu	Kaena Point	3	\$0.057
		Kaena Point	15	\$0.058
		Kahuku	30	\$0.055
		Kahuku	50	\$0.054
		Kahuku	80	\$0.057

Small-Scale Applications Also Exist

- *Grid-connected*
- *Remote, off-grid*
- *Applications on all islands*



- *Only small-scale applications considered on Molokai and Lanai*

Conclusions

- *Significant cost and performance improvements achieved since 1995*
- *Wind and geothermal offer least cost*
- *Significant opportunities exist on all islands*